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VOLUME CONTROL FOR RADIO RECEIVER

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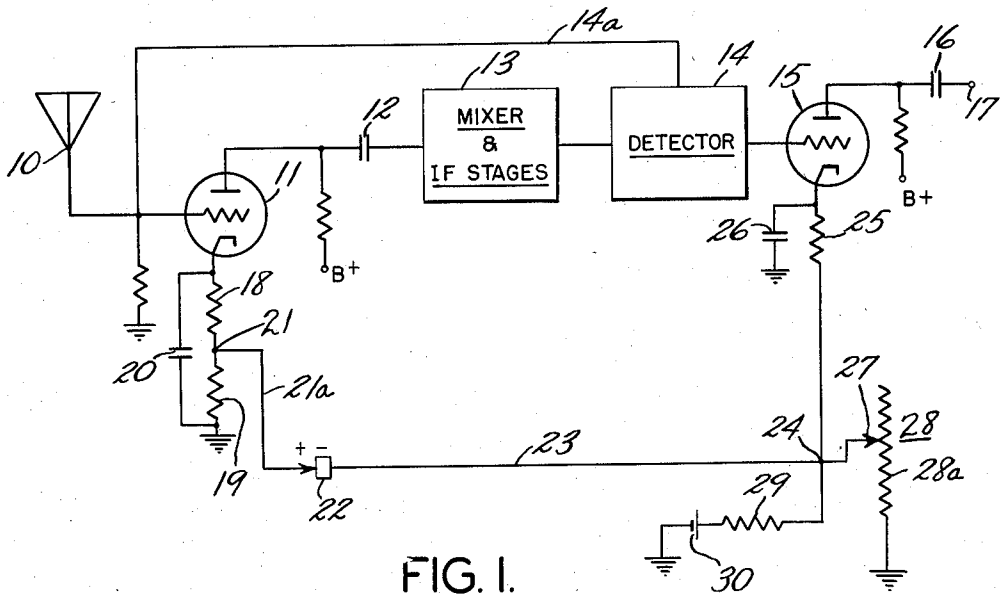

FIG. 1.

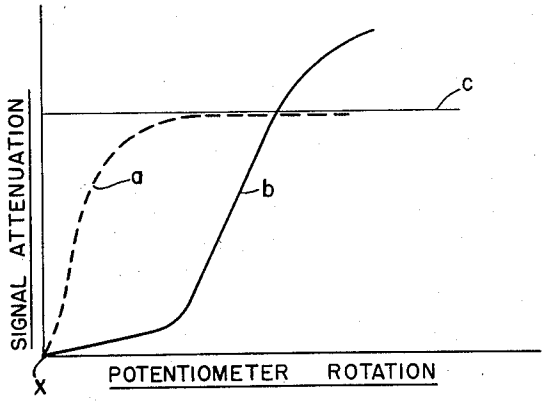

FIG. 2.

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VOLUME CONTROL FOR RADIO RECEIVER

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This invention relates to volume controls, and has particular reference to a unitary volume control for simultaneously varying the sensitivity of a plurality of stages in a radio receiver.

It is often desirable in radio receivers to coincidently vary the sensitivity of a plurality of stages in order to substantially attenuate in a predetermined manner the signal appearing at the receiver output terminals. In the past, a separate volume control has been provided to reduce, for example, the R. F. sensitivity to eliminate undesirable noise from static and the like in the absence of a strong signal, the conventional volume control being employed to attenuate the audio signals to any desired degree.

Another arrangement commonly used requires a plurality of potentiometers with a single control, the taps thereon being mechanically interconnected to provide a predetermined relation between the reduction of the sensitivity in the various stages. However, difficulties were encountered in this arrangement when employed in the R. F. and A. F. stages since it was impossible to provide a high rate of attenuation of the R. F. signals and a low rate of attenuation of the A. F. signals with the initial decrease in volume together with an upper limit of R. F. signal attenuation as the volume is decreased beyond a certain point. The lack of such a relationship often resulted in a complete cut-off of the R. F. signals when the audio gain was reduced the desired amount.

The present invention overcomes the above-recited disadvantages of the prior art arrangements by a novel use of a potentiometer and other means for controlling the sensitivity of a plurality of stages in a radio receiver. In a preferred embodiment of the invention as applied to the R. F. and A. F. stages of a receiver, a unidirectional conducting device is provided between the R. F. stage and the potentiometer and a direct connection to the potentiometer is afforded the A. F. stage. With this arrangement, the R. F. stage may be selectively biased to a predetermined point, and beyond that point, due to the non-conduction of the unidirectional device, the potentiometer will have no effect on the R. F. signals but will only serve to reduce the gain of the audio amplifier.

These and further advantages of the invention will be more readily understood when the following description is read in connection with the accompanying drawings in which:

Figure 1 is a schematic diagram of a circuit embodying the present invention: and

Figure 2 presents two curves helpful in explaining the operation of the circuit illustrated in Figure 1.

Referring to the drawing and more particularly to Figure 1, an incoming signal is picked up by an antenna **10** and applied to a radio frequency (R. F.) amplifier **11** shown as a conventionally connected triode. The signal is next coupled through a condenser **12** and a mixer and intermediate frequency (I. F.) amplifier **13** to a detector **14**, an automatic volume control connection **14***a* preferably being provided therefrom to R. F. amplifier **11**. The resulting signals are coupled through the audio amplifier **15**, shown as a conventionally connected triode, and a condenser **16** to an output terminal **17**.

In order to control the sensitivity of the R. F. amplifier, a pair of resistors **18** and **19**, by-passed to ground by a condenser **20**, are provided between the cathode of the R. F. amplifier **11** and ground. A common connection point **21** of the resistors **18** and **19** is joined by a conductor **21***a* to a rectifier **22**, in turn tied by a conductor **23** to a junction point **24**.

Examining the audio amplifier control circuits, a resistor **25**, conventionally by-passed to ground by a condenser **26**, is disposed between the cathode of the audio amplifier **15** and the point **24** and returns to ground through a movable tap **27** and a resistor **28***a* forming a potentiometer **28**. Also connected between ground and the point **24** through a resistor **29** is a source of relatively low D.-C. potential shown as a battery **30**, the positive side thereof being coupled to the point **24**. It is apparent that as the tap **27** moves, the potential at the point **24** will vary due to the voltage dividing action of the resistors **28***a* and **29**. It will be understood that if desirable, the battery **30** and resistor **29** could be connected between the free end of the resistor **28***a* and ground, the manner of obtaining a desired voltage at the tap **27** being a question of choice.

In a typical operation of the above-described embodiment of this invention, it will be assumed that it has become desirable to decrease the volume of the radio set to eliminate excessive noise. Accordingly, the tap **27** is adjusted along the resistor **28***a* away from ground, thereby placing the point **24** at increasingly higher potentials. The resistor **28***a* has been chosen so that the initial movement of the tap **27** as described above will provide a relatively low rate of resistance increase and therefore a low rate of attenuation of the audio frequency signals as shown by a curve *b* in Figure 2. However, by properly choosing the values of the R. F. amplifier cathode resistors **18** and **19**, the removal of the effective ground from the junction point **21** by the adjustment of the tap **27** will cause a positive voltage to be generated across the parallel combination of the resistor **19** and the resistor **28***a*, such voltage having a value sufficient to attenuate the R. F. signals in accordance with a dotted curve *a* also shown in Figure 2.

As the volume is further decreased by adjustment of the tap **27**, the point **24** will increase in potential until it equals the voltage that would be found at the point **21** if the conductor **21***a* was not joined thereto. At this point, since the rectifier **22** can conduct in only one direction, further increases in the potential at the point **24** will fail to affect the bias on the R. F. amplifier **11**, such bias remaining at a constant value and providing a constant signal attenuation as indicated by a line *c* in Figure 2. However, the audio frequency signals may be further attenuated as is shown by the curve *b*.

It will be apparent that the reverse action will occur as the volume is increased and it is obvious that with this arrangement, it is possible to eliminate much of the undersirable receiver noise without completely desentizing the R. F. stage.

It will be understood that the above-described embodiment of the invention is illustrative only and that modifications thereof will occur to those skilled in the art. For example, the point **24** could be directly connected to the cathode of the A. F. amplifier **15** if the tube type utilized required no bias or grid bias. Furthermore, if it became desirable to attenuate the signals by controlling the grids instead of the cathodes of the tubes, the polarity of the battery **30** and the rectifier **22** could

be reversed and the system, it is obvious, would operate in the same manner as the above-described arrangement. Also, it is obvious as indicated heretofore that the principles of the invention are not limited to the R. F. and A. F. stages but may be applied to other stages in a receiver in any desired combination. Therefore, the invention is not to be limited to the specific apparatus disclosed herein but is to be defined by the appended claims.

I claim:

1. A volume control for a radio receiver having a plurality of stages comprising means providing a variable potential, control means in each of said stages supplying them with a bias potential with respect to a reference potential, a unidirectional conducting device coupling the variable potential to a point on one of the control means at a potential intermediate the bias potential and the reference potential, said unidirectional conducting device being polarized to condut only when the variable potential is less than the intermediate potential to limit sensitivity reduction in the stage controlled by said one control means, and conducting means coupling at least one other of the control means to said variable potential for simultaneously varying the sensitivities of said stages in a selected relation.

2. Apparatus as defined in claim 1 wherein said stage controlled by the one control means receives signals prior to the stage controlled by the other control means.

3. A volume control for a radio receiver including radio frequency and audio frequency stages comprising a resistor carrying a movable tap, means providing a potential on said tap varying in accordance with its position on the resistor, control means supplying the radio frequency stage of the receiver with a bias potential with respect to a reference potential, a unidirectional conducting device coupling the movable tap to a point on the control means at a potential intermediate the bias potential and the reference potential, said unidirectional conducting device being polarized to conduct only when the potential on the tap is less than the intermediate potential to limit sensitivity reduction in the radio frequency stage, and means controlling the audio frequency gain of the receiver coupled to said tap.

4. Apparatus as defined in claim 3 wherein said radio frequency stage includes electron tube means, and said means controlling the radio frequency stage comprises resistance means connected between the cathode of said electron tube means and ground.

5. A volume control for a radio receiver including radio frequency and audio frequency stages comprising a potentiometer grounded at one end and carrying a movable tap, means varying the potential of the tap in accordance with its position, a first electron tube in the radio frequency stage having its cathode coupled through resistance means for providing a bias potential with respect to ground, a rectifier coupling said tap to a point on said resistance means at a potential intermediate said bias potential and ground, the rectifier being polarized to conduct only when the potential on the tap is less than the intermediate potential to limit sensitivity reduction in the radio frequency stage, a second electron tube in the audio frequency stage, and conducting means coupling said tap to the cathode of said second electron tube for controlling its sensitivity.

6. Apparatus as defined in claim 5 wherein said means varying the potential of the tap includes a source of potential connected thereto.

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